**3GPP TSG-RAN WG2 Meeting #122 *R2-230xxxx***

**Incheon, South Korea, 22– 26 May 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **38.300** | **CR** | **Num** | **rev** | **-** | **Current version:** | **17.4.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Introduction of MT-SDT in Stage-2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_NR\_MT\_SDT-Core | | | | |  | ***Date:*** | | | 2023-08 |
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| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of MT-SDT. | | | | | | | | |
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| ***Summary of change:*** | | Implemented RAN2#120 agreements:   1. For RAN paging, MT-SDT indication (at least one bit) is explicitly included per UE via a paging message. FFS if more information for MT-SDT are needed FFS what the indication will be called. FFS signalling details 2. Rel-18 MT-SDT after the MT-SDT paging trigger is detected, RA-SDT and CG SDT solutions/procedures specified in Rel-17 is re-used as a baseline. The detailed triggers will be discussed on case by case. FFS on resources used for access 3. UE can use non-SDT random access resources for accessing the network for an MT-SDT transfer. The UE can also use the configured grant resources and/or MO-RA resources. 4. The network should be able to differentiate why the UL access was triggered, i.e. implicit or explicit indication by the UE. 5. MT-SDT is data that belongs to bearers that are configured for SDT. FFS whether the configuration is MO-SDT or MT-SDT specific. The network can only trigger MT-SDT if the data belongs to those bearers. 6. New Resume cause in RRC resume will be introduced, one code point MT-SDT indication   Implemented RAN2#121 agreements:   1. Include a one-bit indication in paging to trigger MT-SDT. We will ensure that the CCCH message can be transmitted over CG. 2. Indication is per UE. FFS on signalling. 3. In case condition for paging triggered MT-SDT is not fulfilled the UE initiates RRC Resume procedure. Resume cause FFS 4. Upon receiving MT-SDT trigger, the UE shall initiate SDT procedure if the following checks are satisfied (all these same as Rel-17)   - FFS a: Check for DVT (if UL data becomes available in UL)  - b: Check for SDT RSRP threshold  - c: Check for TA validation before selecting CG (if applicable)  - d: Check for SSB level RSRP threshold for CG resource (if applicable)   1. RBs configured for SDT are common for MO-SDT and MT-SDT 2. To confirm that when SDT is initiated due to MT-SDT, UE can exchange subsequent DL/UL SDT data on the resumed RBs. This clarifies the RB behaviour of related RAN2#120 agreement. 3. Specify a RRC procedure for RRCResume for MT-SDT initiation without checking for availability of UL data (i.e. if MT-SDT is initiated first the resume cause will be set to MT-SDT)   Implemented RAN2#122 agreements:   1. Allow support of only MT-SDT in a cell. A separate SIB configuration will be introduced. FFS what is put in there. 2. A separate sdt-RSRP threshold for MT-SDT can be configured, at least in the case where MO-SDT is not configured in the cell. 3. LCH restrictions are checked for DRBs as in MO-SDT (if UL data is available during SDT procedure). Ensure CCCH can be transmitted in CG-SDT when MT-SDT is triggered in stage 3 discussion. 4. RA-SDT resources are not used for MT-SDT initiation RACH 5. In case CG-SDT resources cannot be used or are not available for MT-SDT, UE uses non-SDT RACH for RA-based MT-SDT. FFS whether new triggers are defined 6. When the UE is configured with both MO and MT SDT the radio bearer configuration is common for both.   **Impact analysis**  Impacted functionality: Small data transmission. | | | | | | | | |
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| ***Consequences if not approved:*** | | MT-SDT feature cannot be exploited. | | | | | | | | |
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| ***Clauses affected:*** | | 3.1, 18.0 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*First Modified Subclause*

3.1 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], in TS 36.300 [2] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

5GC 5G Core Network

5GS 5G System

5QI 5G QoS Identifier

A-CSI Aperiodic CSI

AGC Automatic Gain Control

AKA Authentication and Key Agreement

AMBR Aggregate Maximum Bit Rate

AMC Adaptive Modulation and Coding

AMF Access and Mobility Management Function

ARP Allocation and Retention Priority

BA Bandwidth Adaptation

BCCH Broadcast Control Channel

BCH Broadcast Channel

BFD Beam Failure Detection

BH Backhaul

BL Bandwidth reduced Low complexity

BPSK Binary Phase Shift Keying

C-RNTI Cell RNTI

CAG Closed Access Group

CAPC Channel Access Priority Class

CBRA Contention Based Random Access

CCE Control Channel Element

CD-SSB Cell Defining SSB

CFR Common Frequency Resource

CFRA Contention Free Random Access

CG Configured Grant

CHO Conditional Handover

CIoT Cellular Internet of Things

CLI Cross Link interference

CMAS Commercial Mobile Alert Service

CORESET Control Resource Set

CP Cyclic Prefix

CPA Conditional PSCell Addition

CPC Conditional PSCell Change

DAG Directed Acyclic Graph

DAPS Dual Active Protocol Stack

DFT Discrete Fourier Transform

DCI Downlink Control Information

DCP DCI with CRC scrambled by PS-RNTI

DL-AoD Downlink Angle-of-Departure

DL-SCH Downlink Shared Channel

DL-TDOA Downlink Time Difference Of Arrival

DMRS Demodulation Reference Signal

DRX Discontinuous Reception

E-CID Enhanced Cell-ID (positioning method)

EHC Ethernet Header Compression

ePWS enhancements of Public Warning System

ETWS Earthquake and Tsunami Warning System

FS Feature Set

FSA ID Frequency Selection Area Identity

G-CS-RNTI Group Configured Scheduling RNTI

G-RNTI Group RNTI

GFBR Guaranteed Flow Bit Rate

GIN Group ID for Network selection

GNSS Global Navigation Satellite System

GSO Geosynchronous Orbit

H-SFN Hyper System Frame Number

HAPS High Altitude Platform Station

HRNN Human-Readable Network Name

IAB Integrated Access and Backhaul

IFRI Intra Frequency Reselection Indication

I-RNTI Inactive RNTI

INT-RNTI Interruption RNTI

KPAS Korean Public Alarm System

L2 Layer-2

L3 Layer-3

LDPC Low Density Parity Check

LEO Low Earth Orbit

MBS Multicast/Broadcast Services

MCE Measurement Collection Entity

MCCH MBS Control Channel

MDBV Maximum Data Burst Volume

MEO Medium Earth Orbit

MIB Master Information Block

MICO Mobile Initiated Connection Only

MFBR Maximum Flow Bit Rate

MMTEL Multimedia telephony

MNO Mobile Network Operator

MO-SDT Mobile Originated SDT

MPE Maximum Permissible Exposure

MRB MBS Radio Bearer

MT Mobile Termination

MT-SDT Mobile Terminated SDT

MTCH MBS Traffic Channel

MTSI Multimedia Telephony Service for IMS

MU-MIMO Multi User MIMO

Multi-RTT Multi-Round Trip Time

MUSIM Multi-Universal Subscriber Identity Module

NB-IoT Narrow Band Internet of Things

NCD-SSB Non Cell Defining SSB

NCGI NR Cell Global Identifier

NCL Neighbour Cell List

NCR Neighbour Cell Relation

NCRT Neighbour Cell Relation Table

NGAP NG Application Protocol

NGSO Non-Geosynchronous Orbit

NID Network Identifier

NPN Non-Public Network

NR NR Radio Access

NSAG Network Slice AS Group

NTN Non-Terrestrial Network

P-MPR Power Management Maximum Power Reduction

P-RNTI Paging RNTI

PCH Paging Channel

PCI Physical Cell Identifier

PDC Propagation Delay Compensation

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PEI Paging Early Indication

PH Paging Hyperframe

PLMN Public Land Mobile Network

PNI-NPN Public Network Integrated NPN

PO Paging Occasion

PRACH Physical Random Access Channel

PRB Physical Resource Block

PRG Precoding Resource block Group

PRS Positioning Reference Signal

PS-RNTI Power Saving RNTI

PSS Primary Synchronisation Signal

PTM Point to Multipoint

PTP Point to Point

PTW Paging Time Window

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

PWS Public Warning System

QAM Quadrature Amplitude Modulation

QFI QoS Flow ID

QMC QoE Measurement Collection

QoE Quality of Experience

QPSK Quadrature Phase Shift Keying

RA Random Access

RA-RNTI Random Access RNTI

RACH Random Access Channel

RANAC RAN-based Notification Area Code

REG Resource Element Group

RIM Remote Interference Management

RLM Radio Link Monitoring

RMSI Remaining Minimum SI

RNA RAN-based Notification Area

RNAU RAN-based Notification Area Update

RNTI Radio Network Temporary Identifier

RQA Reflective QoS Attribute

RQoS Reflective Quality of Service

RS Reference Signal

RSRP Reference Signal Received Power

RSRQ Reference Signal Received Quality

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

RTT Round Trip Time

SCS SubCarrier Spacing

SD Slice Differentiator

SDAP Service Data Adaptation Protocol

SDT Small Data Transmission

SFI-RNTI Slot Format Indication RNTI

SHR Successful Handover Report

SIB System Information Block

SI-RNTI System Information RNTI

SLA Service Level Agreement

SMC Security Mode Command

SMF Session Management Function

SMTC SS/PBCH block Measurement Timing Configuration

S-NSSAI Single Network Slice Selection Assistance Information

SNPN Stand-alone Non-Public Network

SNPN ID Stand-alone Non-Public Network Identity

SPS Semi-Persistent Scheduling

SR Scheduling Request

SRAP Sidelink Relay Adaptation Protocol

SRS Sounding Reference Signal

SRVCC Single Radio Voice Call Continuity

SS Synchronization Signal

SSB SS/PBCH block

SSS Secondary Synchronisation Signal

SSSG Search Space Set Group

SST Slice/Service Type

SU-MIMO Single User MIMO

SUL Supplementary Uplink

TA Timing Advance

TB Transport Block

TCE Trace Collection Entity

TNL Transport Network Layer

TPC Transmit Power Control

TRP Transmit/Receive Point

TRS Tracking Reference Signal

U2N UE-to-Network

UCI Uplink Control Information

UDC Uplink Data Compression

UE-Slice-MBR UE Slice Maximum Bit Rate

UL-AoA Uplink Angles of Arrival

UL-RTOA Uplink Relative Time of Arrival

UL-SCH Uplink Shared Channel

UPF User Plane Function

URLLC Ultra-Reliable and Low Latency Communications

VR Virtual Reality

V2X Vehicle-to-Everything

Xn-C Xn-Control plane

Xn-U Xn-User plane

XnAP Xn Application Protocol

*Next Modified Subclause*

18 Small Data Transmission

18.0 General

Small Data Transmission (SDT) is a procedure allowing data and/or signalling transmission while remaining in RRC\_INACTIVE state (i.e. without transitioning to RRC\_CONNECTED state). SDT is enabled on a radio bearer basis and can be initiated either by the UE for MO-SDT (Mobile Originated SDT) or by the network for MT-SDT (Mobile Terminated SDT). SDT for MO-SDT is initiated by the UE only if less than a configured amount of UL data awaits transmission across all radio bearers for which MO-SDT is enabled, the DL RSRP is above a configured threshold, and a valid SDT resource is available as specified in clause 5.27.1 of TS 38.321 [6]. SDT for MT-SDT is initiated by the network with an indication to the UE in a paging message when DL data awaits transmission for MT-SDT radio bearers; based on the indication, the UE initiates the SDT for MT-SDT only if the DL RSRP is above a configured threshold as specified in clause 5.27.X of TS 38.321 [6]. When SDT is initiated for MT-SDT by the UE, a resume cause indicating MT-SDT is included in the *RRCResumeRequest/RRCResumeRequest1.* Maximum duration the SDT procedure can last is dictated by a SDT failure detection timer that is configured by the network (see clause 6.2.2 of TS 38.331 [12]). Network can enable either or both of the MO-SDT and MT-SDT in a cell.

SDT procedure is initiated with either a transmission over RACH (configured via system information) or over Type 1 CG resources (configured via dedicated signalling in *RRCRelease*). The SDT resources can be configured on initial BWP for both RACH and CG. RACH and CG resources for SDT can be configured on either or both of NUL and SUL carriers. The CG resources for SDT are valid only within the PCell of the UE when the *RRCRelease* with suspend indication is received. CG resources are associated with one or multiple SSB(s). For RACH, the network can configure 2-step and/or 4-step RA resources for SDT. When both 2-step and 4-step RA resources for SDT are configured, the UE selects the RA type according to clause 9.2.6. If SDT procedure is initiated for MT-SDT over RACH, only the RACH not configured for SDT can be used by the UE. When SDT resources are not configured for RACH nor CG in the serving cell, only SDT procedure for MT-SDT can be supported. CFRA is not supported for SDT over RACH.

Once initiated, the SDT procedure is either:

- successfully completed after the UE is directed to RRC\_IDLE (via *RRCRelease*) or to continue in RRC\_INACTIVE (via *RRCRelease or RRCReject*) or to RRC\_CONNECTED (via *RRCResume or RRCSetup*); or

- unsuccessfully completed upon cell re-selection, expiry of the SDT failure detection timer, a MAC entity reaching a configured maximum PRACH preamble transmission threshold, an RLC entity reaching a configured maximum retransmission threshold, or expiry of SDT-specific timing alignment timer while SDT procedure is ongoing over CG and the UE has not received a response from the network after the initial PUSCH transmission.

Upon unsuccessful completion of the SDT procedure, the UE transitions to RRC\_IDLE.

For SDT, network should not send *RRCReject* in response to *RRCResumeRequest/RRCResumeRequest1* if DL data over any radio bearer configured for SDT is transmitted.

The initial PUSCH transmission during the SDT procedure includes at least the CCCH message. When using CG resources for initial SDT transmission, the UE can perform autonomous retransmission of the initial transmission if the UE does not receive confirmation from the network (dynamic UL grant or DL assignment) before a configured timer expires as specified in clause 5.4.1 of TS 38.321 [6]. After the initial PUSCH transmission, subsequent transmissions are handled differently depending on the type of resource used to initiate the SDT procedure:

- When using CG resources, the network can schedule subsequent UL transmissions using dynamic grants or they can take place on the following CG resource occasions. The DL transmissions are scheduled using dynamic assignments. The UE can initiate subsequent UL transmission only after reception of confirmation (dynamic UL grant or DL assignment) for the initial PUSCH transmission from the network. For subsequent UL transmission, the UE cannot initiate re-transmission over a CG resource.

- When using RACH resources, the network can schedule subsequent UL and DL transmissions using dynamic UL grants and DL assignments, respectively, after the completion of the RA procedure.

While the SDT procedure is ongoing, if data appears in a buffer of any radio bearer not enabled for SDT, the UE initiates a transmission of a non-SDT data arrival indication using *UEAssistanceInformation* message to the network and, if available, includes the resume cause.

SDT procedure over CG resources can only be initiated with valid UL timing alignment. The UL timing alignment is maintained by the UE based on a SDT-specific timing alignment timer configured by the network via dedicated signalling and, for initial CG-SDT transmission, also by DL RSRP of configured number of highest ranked SSBs which are above a configured RSRP threshold. Upon expiry of the SDT-specific timing alignment timer, the CG resources are released while maintaining the CG resource configuration.

Logical channel restrictions configured by the network while in RRC\_CONNECTED state and/or in *RRCRelease* message for radio bearers enabled for SDT, if any, are applied by the UE during SDT procedure.

The network may configure UE to apply ROHC continuity for SDT either when the UE initiates SDT in the PCell of the UE when the *RRCRelease* with suspend indication was received or when the UE initiates SDT in a cell of its RNA.

*End of Changes*

# Annex (not part of the specification): RAN2 agreements:

## RAN2#120

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| 1. For RAN paging, MT-SDT indication (at least one bit) is explicitly included per UE via a paging message. FFS if more information for MT-SDT are needed FFS what the indication will be called. FFS signalling details  2. Rel-18 MT-SDT after the MT-SDT paging trigger is detected, RA-SDT and CG SDT solutions/procedures specified in Rel-17 is re-used as a baseline. The detailed triggers will be discussed on case by case. FFS on resources used for access  3. UE can use non-SDT random access resources for accessing the network for an MT-SDT transfer. The UE can also use the configured grant resources and/or MO-RA resources.  4. The network should be able to differentiate why the UL access was triggered, i.e. implicit or explicit indication by the UE.  5. MT-SDT is data that belongs to bearers that are configured for SDT. FFS whether the configuration is MO-SDT or MT-SDT specific. The network can only trigger MT-SDT if the data belongs to those bearers.  6. It is possible for the network to configure only MT-SDT without MO-SDT RA resources and/or CG-SDT. Subsequent UL/DL data belonging to SDT bearers while in INACTIVE is allowed like MO-SDT procedure. FFS stage 3 details  7. New Resume cause in RRC resume will be introduced, one code point MT-SDT indication |

## RAN2#121

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| 1. Include a one-bit indication in paging to trigger MT-SDT. We will ensure that the CCCH message can be transmitted over CG.  2. Indication is per UE. FFS on signalling.  3. In case condition for paging triggered MT-SDT is not fulfilled the UE initiates RRC Resume procedure. Resume cause FFS  4. Upon receiving MT-SDT trigger, the UE shall initiate SDT procedure if the following checks are satisfied (all these same as Rel-17)  - FFS a: Check for DVT (if UL data becomes available in UL)  - b: Check for SDT RSRP threshold  - c: Check for TA validation before selecting CG (if applicable)  - d: Check for SSB level RSRP threshold for CG resource (if applicable)  5. When UE resumes for MT-SDT, UE resumes all RBs configured for SDT  6. RBs configured for SDT are common for MO-SDT and MT-SDT  7. If there is valid CG-SDT resources, the UE should use CG-SDT to transmit the response. FFS on whether we need to optimize for case when CG periodicity is too long  8. To confirm that when SDT is initiated due to MT-SDT, UE can exchange subsequent DL/UL SDT data on the resumed RBs. This clarifies the RB behaviour of related RAN2#120 agreement.  9. Specify a RRC procedure for RRCResume for MT-SDT initiation without checking for availability of UL data (i.e. if MT-SDT is initiated first the resume cause will be set to MT-SDT)  10. UE is allowed to initiate either MO-SDT based resume or non-SDT based resume at any point (before initation RRCResumeRequest for MT-SDT) using separate procedures  11. If MT-SDT procedure is initiated, for RACH during subsequent data transfer (i.e. RACH triggered due to SR), UE uses only the non-SDT RACH resources (i.e. like legacy) |

## RAN2#122

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| 1. Allow support of only MT-SDT in a cell. A separate SIB configuration will be introduced. FFS what is put in there.  2. For paging indication signalling, a new list of paging records for MT-SDT indication is optionally included in paging message using non critical extension. Each record in this list optionally includes 1 bit MT-SDT indication. UE identity and access type are not included in paging record of this list.  3. gNB may include MT-SDT indication in paging message only if UE’s I-RNTI is included in the paging message (i.e. MT-SDT is only used by RAN initiated paging).  4. UE selects '0' as the Access Category when the resumption of the RRC connection is triggered by response to the MT-SDT triggering in a PAGING message  5. MT-SDT is only applicable to the legacy MT-Access use case (i.e. it is not applicable to access identities 1, 2 and 11-15).  6. SRB2 can be used for MT-SDT (i.e. similar to MO-SDT)  7. No additional enhancement is needed specifically for RedCap UE to monitor paging for MT-SDT  8. When RRC resume is triggered due to MT-SDT and in the case the condition for paging triggered MT-SDT is not fulfilled, the UE initiates RRC Resume procedure with Resume cause “mt-Access”.  9. A separate sdt-RSRP threshold for MT-SDT can be configured, at least in the case where MO-SDT is not configured in the cell.  10. RRC explicitly indicates to MAC whether resume is trigged due to MT-SDT  11. LCH restrictions are checked for DRBs as in MO-SDT (if UL data is available during SDT procedure). Ensure CCCH can be transmitted in CG-SDT when MT-SDT is triggered in stage 3 discussion.  12. Assumption is that if the UE has UL data the UE can still check and trigger MO-SDT (it is up to UE implementation)  13. RA-SDT resources are not used for MT-SDT initiation RACH  14. In case CG-SDT resources cannot be used or are not available for MT-SDT, UE uses non-SDT RACH for RA-based MT-SDT. FFS whether new triggers are defined  15. There is no need to define new Rel-18 CG configurations specific to MT-SDT.  16. When the UE is configured with both MO and MT SDT the radio bearer configuration is common for both.  17. For both MO and MT-SDT, if the next CG-SDT resource is too far, then RACH resource can be selected first. This is checked at the point of initial resource selection (e.g. CG SDT selection). FFS what is too far and how this is configured. Assumption is that we will continue this discussion in SDT session.  18. SPS will not be supported for Rel-18 SDT |